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A COMPREHENSIVE PLAN FOR COORDINATION AND OVERSIGHT OF WATER RESEARCH IN THE STATE OF MONTANA

A Report to the

WATER POLICY COMMITTEE,
MONTANA STATE LEGISLATURE

by the

INTERAGENCY WATER RESEARCH POLICY
ADVISORY BOARD

and the

COMMISSIONER OF HIGHER EDUCATION

June 8, 1990

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INTRODUCTION

Water is one of the most important natural resources in Montana. In addition to being life sustaining, water is an integral requirement in virtually every element of Montana's economy. Because of these interrelationships, policy decisions relating to the use and management of water have become increasingly complex.

Good water policy and water management decisions must be based on sound information. The role that research plays in expanding the knowledge base for decision makers and the general public is becoming more evident and more appreciated. In 1985, the Montana Legislature passed a water policy act that established a standing, joint Water Policy Committee of the legislature. This committee was empowered to oversee the policies and activities of state agencies and institutions as they effect the water resources of the state. Additionally, the Water Policy Committee was instructed to "analyze and comment on water-related research undertaken by any state agency, institution, college, or university".

Pursuant to this responsibility, the Water Policy Committee reviewed water research at its December 11, 1987 meeting. The committee heard testimony from state agency and university personnel relative to water research in Montana. Concern was expressed regarding fragmentation of research efforts and the lack of a clear focus on Montana priorities. Much of the discussion focused on the Montana University System Water Resources Center and its potential for becoming a focal point for water research in the state. A subcommittee composed of Sen. Bengtson and Rep. Marks was appointed to initiate discussions with the University System relative to a restructuring of water research efforts.

This subcommittee, along with staff from the Environmental Quality Council, met with Dr. Carrol Krause, Commissioner of Higher Education, at his office in January, 1988. In the course of the meeting, the Commissioner agreed to facilitate a review of water research in the University System and to share the results with the Water Policy Committee at its next scheduled meeting. Subsequently, the Commissioner met with the Research Vice Presidents, the Dean of Agriculture and the directors of several University System organizations that have water research elements. This group reviewed current water research efforts and discussed how improved coordination and cooperation would benefit university system programs, state agencies, and policy decision-makers.

Commissioner Krause met with the Water Policy Committee on Feb. 26, 1988 and reported that he had, indeed, found a need for better coordination within the University System water research programs. He suggested that further consideration be given to the subject and that the discussion be broadened to include a comprehensive review of all water research and related activities in the state. At the request of the Water Policy Committee, Commissioner Krause agreed to facilitate this review.

With the Water Resources Center acting as staff for the Commissioner, two meetings were organized to discuss the subject. The first meeting (April 6, 1988) involved administrators from both the university system and from the state water agencies. Discussion at this meeting centered on the differences and similarities of water research and related activities within the university system and state agencies, and on possible means of coordination. At the recommendation of this group, a second meeting was organized that involved legislative and private sector representatives, middle management level personnel from state and federal water agencies, and researchers and administrators from the University System. This group met on June 13, 1988 in a day-long, "think tank" session to consider the research needs of the state, and institutional and infrastructure arrangements that would be necessary to meet those needs. A list of participants at this meeting is included in Appendix One.

Based primarily on the discussions of these two meetings, a report was prepared and presented to the Water Policy Committee on October 17, 1988, by the Commissioner. A copy is included as Appendix Two of this document. This report contained the recommendations of the "think tank" group which are as follows:

1. Unify state supported research efforts
2. Establish an information clearinghouse
3. Establish an education program
4. Establish a funding mechanism sufficient to implement recommendations one through three above.

It was recommended that an Interagency Water Research Policy Advisory Board be established to work out the details of how these recommendations could best be implemented. It was recommended that this board be composed of top level administrators in the state agencies and university system, appropriate legislative committee members, and influential individuals in the private sector.

The Water Policy Committee asked the Commissioner to proceed with the Policy Advisory Board and to develop a detailed plan for the integration and coordination of water research and related activities. This plan was to be reported back to the Water Policy Committee for further consideration.

Pursuant to these directions, the Commissioner appointed membership to the Policy Board. This membership was drawn from the executive and legislative branches of state government, the university system and the private sector. Membership consists of the following:

Executive Branch

Karen Barkley, Dir.,
Dept of Natural Res.
and Conservation

Don Pizzini, Dir.
Dept. of Health and
and Envir. Sciences

Glen Marx,
Science Adv.,
Governor's
Office

Legislative Branch

Sen. Esther Bengtson

Rep. Bob Marks
Rep. Ed Grady*

Rep. Bob Thoft

University System

John Jutila, Vice
Pres. for Research,
Montana State Univ.

Ray Murray, Vice
Pres. for Research
Univ. of Montana

David Toppen,
Vice President
Montana Tech.

Private Sector

Howard van Noy,
Senior Vice Pres.,
Montana Power Co.
Butte

John Thorson,
Attorney,
Doney and Thorson,
Helena

Orin Ferris,
Dir., Water
Res. Division,
H.K.M. Engr.
Billings

*In February, 1990, Rep. Ed Grady replaced Rep. Bob Marks who had resigned his legislative seat to become the Director of Administration for the State.

The Water Research Policy Advisory Board has convened for three meetings at the call of the Commissioner, who serves as Chairman and ex-officio member of the Board. The Water Resources Center serves as staff for the Board.

The first meeting, held on July 25, 1989, set the scope for the Boards activities. Board members heard presentations from university and state officials relative to water research and related activities within these units. A presentation was made by Howard Johnson and John Thorson on the results of a study of

Water Research Institutes in other states that they had been commissioned to do by the Environmental Quality Council. Discussions by the Board then centered on research efforts within the state, the sources of funding and the role of the Board in providing direction to this effort. The Board requested more specific and more detailed information on water research and related activities be presented at the next meeting.

The second meeting of the Board was held on Oct. 17, 1989. Detailed presentations were made on research programs within the university system and the state agencies. Officials from the Wyoming Water Center, the Wyoming State Water Commission and the Wyoming Legislature were present to discuss the financial and institutional arrangements for water research and related activities in that state. Discussion by the Board then centered on maximizing the benefits from Montana's expenditures in the areas of water research, water data management, information transfer and education. The Board requested a draft plan to accomplish this be prepared for its consideration at the next meeting.

The third meeting of the Board was held on February 22, 1990. The focus of this meeting was on the institutional arrangements that would be necessary and desirable to insure coordination and oversight of Montana's water research efforts. The Board requested that a report be prepared containing their findings and recommendations. The remainder of this report contains that information. The Board feels that the program herein recommended will maximize the benefits of current state expenditures on water research, water data management, information transfer and education.

FINDINGS OF THE INTERAGENCY WATER RESEARCH POLICY ADVISORY BOARD

Water is one of the most important natural resources in Montana. It is not surprising, therefore, that water-related topics are addressed by several state agencies and by several units of the university system. Water-related areas in which overlap exists between state agencies, between agencies and the university system, and between the units of the university system include research, data management, information transfer and education. Because these elements are viewed in slightly different contexts by each of these entities, working definitions of these terms are necessary. Definitions of the terms as used by the Board in its deliberations are included as Appendix Three to this report. A discussion of the current efforts in each of these areas is given below.

WATER RESEARCH

Most of the water-related research that is conducted in Montana is done within the University System. Some state agencies do have limited research programs and several state entities contract for and oversee research and/or monitoring programs.

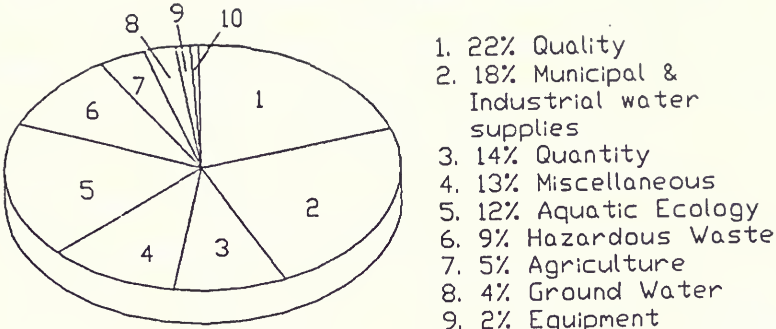
University Research

There are two categories of water-related research that are conducted in the University System. These include grant-and-contract research and programmatic research.

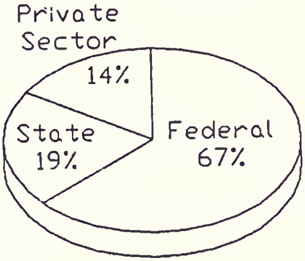
Grant-and-Contract Research. Work done in this category is virtually all done on a faculty initiated basis. It consists of both basic and applied research. **Basic research** is funded primarily by federal agencies such as the National Science Foundation, the National Institute of Health, etc. Within broad guidelines, these agencies respond to ideas presented to them by proposals submitted by faculty. These proposals naturally address areas in which the proposer has considerable interest and expertise.

Applied research is much more opportunistic in that the faculty must respond to specific needs of the funding agencies. Requests for Proposals (RFP) specifically state the objectives that are to be pursued and require the faculty to focus specifically on those objectives. Funding for applied research comes from a wider variety of sources including mission-oriented federal and state agencies and private sector foundations and industry.

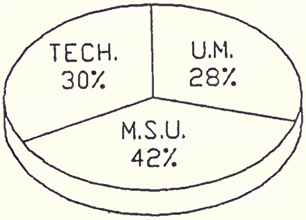
Faculty within the university system have been very successful in obtaining research through grant-and-contract opportunities. Figure 1 on the following page summarizes these activities with respect to categories of research, grant sources and university unit. **It should be emphasized that state funds allocated to research on a grant-and-contract basis consists primarily of federal pass-through dollars.**



(a)
FY 1989
Expenditures on water related
research was approximtely
$3,000,000



(b)



(c)

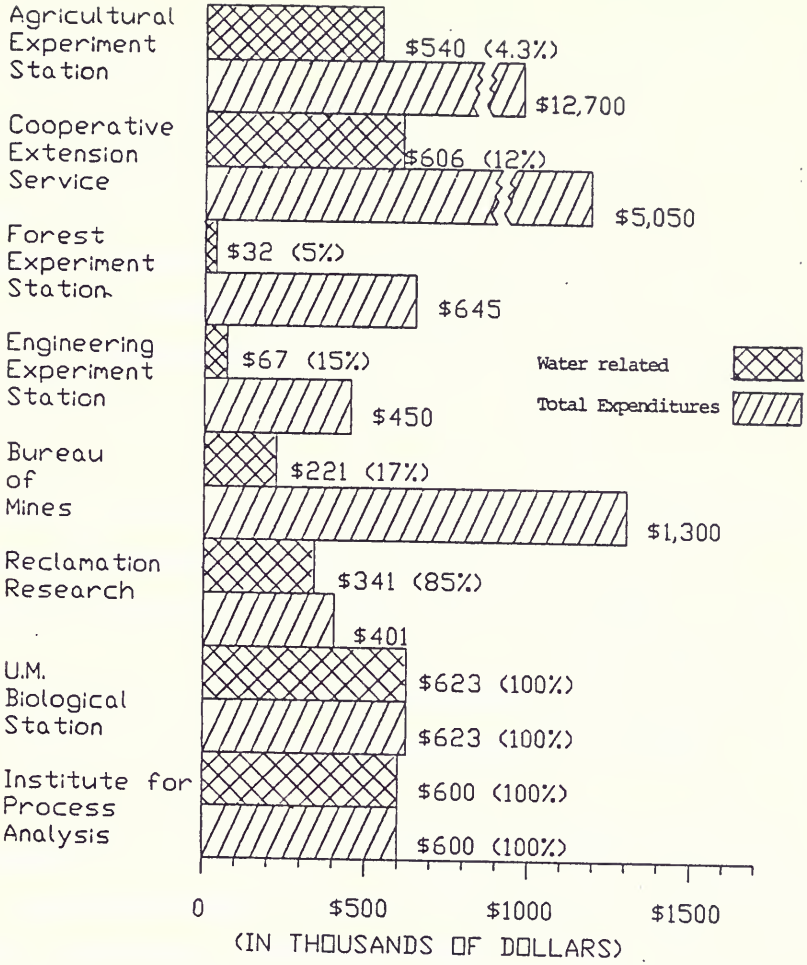
FIG. 1
Water Related Research
Grants and Contracts
FY 1989

Programmatic Research. There are several programs within the university system that include some aspect of water research, information transfer, data management or education in their overall activities. These programs are listed in Figure 2 on the following page. An estimate of the relative effort in the water area can be made by comparing annual water-related expenditures to total program expenditures.

Analysis

Although the grant-and-contract research activity is the major water-related research program in Montana in terms of dollars, very little has been done in an effort to coordinate or to provide oversight to this activity. The principal reason for this lies within the nature of this activity. This research is funded by a variety of organizations, each with their own agenda and expectations relative to what they should get for their dollars.

It is not possible to orient grant-and-contract research specifically toward Montana's needs and priorities. Any attempt to do so would have a negative impact when funding agencies perceived that the state's agenda, not their own, was being followed. Notwithstanding the lack of a state focus to the grant-and-contract research, this activity must not be discouraged, but rather should be fostered and encouraged for the following reasons:



Total water-related expenditures = $3.030,000 (14%)
Total expenditures = $21,769,000

FIG. 2
Programatic Research
FY 1989

1) Faculty are expected to secure and conduct research as a part of their professional development, and to provide research experiences for students. Promotion, tenure and salary increases are all tied to the faculty's production in terms of research grants and publications resulting from that work.
2) Research and subsequent publications enhances the stature of the university and the department in which it is done.
3) Externally funded research provides a source of income to the university through indirect cost recovery, and through the salaries paid to faculty and graduate students.
4) Purchase of goods and services through the research program benefits both local and state economies.

The water elements in programmatic areas of research are integrated with other elements of the program to maximize its overall effectiveness. Thus any attempt to re-orient these water elements toward a set of external priorities would not be in the best interest of the overall program. Several of the programs rely on grant-and-contract activity for a significant part of their funding and are subject to the same limitations that were earlier described.

Agency Research

Within the context of the definitions in Appendix Three, the state agencies do little water research. A possible exception may be the Department of Fish, Wildlife, and Parks (FWP) where its research unit sometimes conducts research on water as it relates to fisheries and/or wildlife management. A Memorandum of Understanding has been worked out by FWP and the fishery units at both Montana State University and the University of Montana to insure that the three programs are coordinated.

Most of the effort by agency personnel falls under the category of monitoring as was discussed earlier. Agencies do contract for research, however, with faculty within the University System and with consulting professionals. As was mentioned earlier, much of the contracted research dollars are federal funds that are channeled through the state agency. An example of this is the Environmental Protection Agency (EPA) Superfund money that goes to the State Department of Health and Environmental Sciences (DHES) to assist in managing Superfund sites in Montana. Part of these funds are often passed through to university faculty for necessary research. Likewise, the Department of Natural Resources and Conservation may pass through dollars from both the private and public sector to obtain assistance in research relating to the Facilities Siting Act or other department functions.

Analysis

Research sponsored by the state agencies is subject to many of the same restrictions that limits the prioritization of research in the University System. Pass-through federal dollars are committed to specific uses while state funds are planned as an integral part of the department's mission. Any re-direction of these funds would either be impossible or could be detrimental to the overall function of the agency.

Other Research Programs

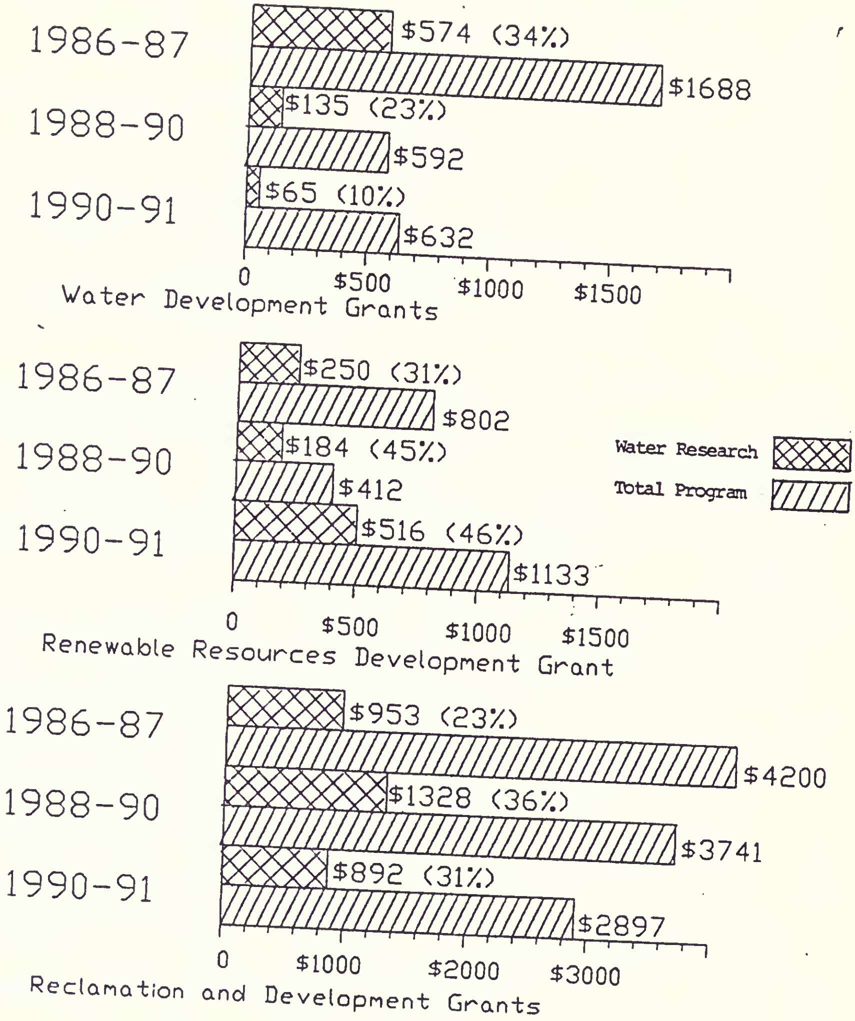
There are three grant programs that are currently funded by the legislature that have elements of water research included. These are the **Water Development Grant Program**, the **Renewable Resource Development Program** and the **Reclamation and Development Grant Program**. Although research is not the primary focus of any of these programs, it is an allowable category under all three.

These programs are administered by the Conservation and Resource Development Division of the Department of Natural Resources and Conservation (DNRC). A Call for Proposals listing broad categories of possible projects receives wide circulation throughout the state. Proposers of projects respond with proposals that are reviewed by a panel selected by DNRC. This panel is drawn from a wide spectrum of interests and expertise. Panel recommendations assist DNRC in ranking the proposals within each program. This ranking is then submitted to the Governor's office where additional factors sometimes result in a reordering of priorities. Finally, the projects are considered by the Long Range Planning Committee of the Legislature which has the final say regarding the ranking and funding of the projects.

Because priority subject areas are identified in the Call for Proposals, all of the projects, including research projects, address an identified need. However, because the exact nature of the project is often determined by the proposer, based on his/her perception of the state need and his/her research interest and experience, there may not be an exact matching of the project and the preconceived need as identified by the DNRC. The projects are selected somewhat on a "best fit" basis. It is not unreasonable to assume that political factors play a role in the final selection of projects at the executive and legislative level.

Analysis

A significant amount of research is funded by these grant programs. Figure 3 on the following page shows statistics for these grants for the last three bienniums as reported by the DNRC. Expenditures on water research from these three grants have averaged over 1.6 million per biennium. These funds are very significant in that they are virtually the only state dollars that are available for research. Research proposals submitted to these programs must also compete with development and conservation project proposals, all of which are reviewed by panels and individuals that may have little, if any, expertise in research methods and procedures.



Three-Bieannium Average
Water Research (All Grants) = $1,632
Total Program (All Grants) = $5,366

(ALL FIGURES IN THOUSANDS OF DOLLARS)

FIG.3
STATE GRANTS PROGRAMS

Results of completed projects consists of a final report that may be completed years after the grant is awarded. These reports are not currently disseminated in any organized information transfer effort, nor is there an attempt to coordinate the projects with other on-going efforts in the agencies or the university system.

DATA MANAGEMENT

Most of the state entities involved in research and/or monitoring programs have internal data management programs. These range from a hard-copy, filing-cabinet system to storage in electronic files. Additionally, data bases at the national level that include information pertinent to Montana are available through the U.S. Geological Survey and the U.S. Environmental Protection Agency. There are two systems in the state that currently have data management activities designed specifically to serve the Montana water community. These systems are operated by the State Library (Water Information System) and by the Montana Bureau of Mines and Geology (Ground Water Information Center).

The Water Information System

In 1985, the legislature established the Natural Resources Information System (NRIS) at the state library. This program has several features, one of which is the Water Information System (WIS). The WIS has been funded on a biennial basis through grants from the three programs administered by the DNRC that were described earlier.

The WIS program catalogues and indexes data files rather than copying them and merging them into one central file. Effort by the WIS currently focuses on the following four areas:

1. **Water Resources Data Directory.** This directory documents the types of data available from each source, the geographical area of data coverage, whether the data is automated or manual, the type of hardware and software used and the most efficient way to retrieve data from each source.
2. **Access.** An attempt is being made to improve access to the system by users and potential users. This includes the establishment of direct access points to the large data bases and training programs for frequent users who have the necessary computer facilities. Also, a system is being devised whereby potential users, who do not have the equipment necessary for access, can use the facilities at the NRIS office.
3. **Search and Retrieval Services.** For those needing assistance, a search and retrieval system is available to locate and copy information on a fee basis.
4. **Coordination.** Working through an advisory committee, the WIS is improving communication among the owners and users of data bases to enhance data sharing, thus reducing duplication. This effort is also directed at defining "quality indicators", standardizing collection and

analytical procedures, and identifying gaps in data coverage.

The Ground Water Information Center (GWIC)

Management of ground water data is a part of the Bureau of Mines statutory authority. In 1985, grants from the Water Development Grant Program and the Resource Indemnity Trust Fund were obtained to purchase the necessary equipment and to hire the staff to expand the program to a more effective level. The thrust of the program is to develop and maintain a central data base that defines the extent and nature of Montana's ground water resources. Unlike the WIS, where the effort is to index data files stored off-site, the GWIC maintains a central data file where all the data is accumulated and stored on site. Data is supplied to the system from well logs provided by private-sector well drillers, from the Bureau of Mines and other public and private entities whose activities may result in information relating to ground water location, quantity and quality. The program is ongoing and focuses on the following activities.

1. **Organization.** Data that is obtained is organized so that inquiries for information at any given location can be processed and the data quickly retrieved.
2. **Dissemination.** An effort is made to make potential users of the program aware of its availability and to maximize its usefulness to the user.

The GWIC currently processes about 3,500 requests for information each year.

Analysis

Information management programs are essential in maximizing the efforts of research, monitoring and other data gathering activities in the State. Good information management programs can be highly cost effective in that they save vast amounts of time in searching for existing information. They help prevent costly duplication and better management decisions result when good information is available to water professionals. The fact that these data management efforts continue to be funded on "soft" money in competition with development and conservation projects that may be more attractive on a short-term political basis, is a cause for concern among the users of this information.

INFORMATION TRANSFER

Organized information transfer programs relating to water in Montana include limited activities both in the University System and in the state agencies. They include newsletters, reference services, conferences, symposiums and forums. Most of these efforts focus on a narrow constituency although some are joint ventures and are oriented toward broader audiences.

University System

There are few entities within the university system that have a proactive water resources information transfer program. These are described by campus as follows.

Montana State University. The Institute for Chemical and

Biological Process Analysis at MSU produces a newsletter that is circulated to its Industrial Associates and cooperators both on-and-off-campus. Additionally, symposiums and workshops are held primarily for sponsors and active participants in their research program.

The Extension Service is producing a series of technical guidance papers that are being disseminated by the Montana Farm Bureau and Water Resources Center.

Reclamation Research sponsors a biennial symposium focussing on the reclamation of disturbed lands. Topics relating to water are included in this program which attracts a large number of both in-state and out-of-state interests. Proceedings of the conference are widely disseminated through trade journals and other publications in the field.

Montana College of Mineral Science and Technology. Montana Tech does not have an organized information transfer activity that relates to water. There are, however, several departments and faculty members that participate in conferences that relate to water. The Associate Director of the Water Center has recently organized monthly meetings where faculty that are working on water projects can share information.

The University of Montana. The University of Montana does not have an organized water information transfer program on its main campus. Like Montana Tech, the University has just initiated regularly scheduled meetings of faculty interested in water resources. Again, individual departments and faculty participate in conferences and symposiums that relate to water resources on an ad hoc basis.

The University of Montana Biological Station has a newsletter entitled, the "Yellow Bay Journal," that is published by a group called Friends of Yellow Bay. Written in lay terms, this newsletter is published biannually and contains information on the academic and research programs of the Station, including lists of publications. The Biological Station is also active in sponsoring symposiums that cover topics of local, regional, national and international interest.

Montana University System Water Resources Center. The Montana University System Water Resources Center has an active information transfer program that consists of a newsletter, a reference service, and offers a series of symposia and forums. The newsletter, "The Source," is published quarterly and contains news of water projects and events supplied by a variety of water interests. "The Source" has circulation of about 1500 individuals and organizations, most of which are in Montana. The reference service consists of a listing of pertinent documents received by the Water Center. This list is circulated on a quarterly basis to a receivership of about 900 individuals that have requested the service. Readers can request loan of documents from this list for a two-week period. The Center processes requests for approximately 200 documents per quarter. The Water Center sponsors an annual Research Symposium at which the findings of recently completed research projects sponsored by the Center are presented. Additionally, a biannual Water Forum is held just prior to each legislative session in which current water issues are presented from a broad range of perspectives. Leaders from the legislature, the executive branch and from various water groups are involved in this forum. The Water Center has also initiated a Water Interest Group (WIG) on the MSU campus where individuals meet on a monthly basis to present and discuss current research activities.

The Agencies

Several of the state agencies with water-related responsibility publish newsletters to keep target audiences informed about agency activities. These agencies include the Department of Natural Resources and Conservation, the Water Quality Bureau (WQB) of the Department of Health and Environmental Sciences, and the Department of Fish, Wildlife and Parks.

The Department of Natural Resources and Conservation publishes a departmental newsletter that is circulated primarily to staff. Additionally, the Water Resources Division publishes two newsletters, one targeted at floodplain issues and the other at more general water issues. The "Flood Plain Management" newsletter is financed by the Federal Emergency Management Agency and has a circulation of about 550 individuals, consisting primarily of managers of local flood plain ordinances, city and county planners and sanitarians. "Water Lines," a recently initiated by the Water Resources Division, has a circulation of about 3000. This newsletter covers a broad range of local, regional and national issues that have relevance to Montana.

The Water Quality Bureau publishes two newsletters. The "**Clearwater**," is targeted to operators and managers of water and waste water treatment plant operators. Published twice per year, the Clearwater is co-sponsored by the joint education committee of the American Water Works Association and the Water Pollution Control Association. The Water Quality Management Section of the WQB publishes a one page newsletter, the "**Water Column**," which has a small circulation to individuals involved primarily in non-point-source activities.

The Department of Fish, Wildlife and Parks, publishes a quarterly newsletter that relates to fisheries, but often includes water-related-topics such as recent events in water leasing, legislative up-dates, etc.

In addition to newsletters, most of the agencies participate in conferences, symposia and forums that are held by a variety of water interest groups around the state.

Analysis

Most of the information transfer activity focuses on target audiences of the individual organizations. Only two newsletters, the Water Center's "Source" and the DNRC's "Water Line," have general circulation. To date, no effort has been made to produce a comprehensive publication that brings the water-related activities and services of all the agencies and university units together in one document that reaches all water users, managers, and researchers.

EDUCATION

Water-related education consists of formal degree programs and non-degree, continuing education efforts. The degree programs are restricted to the University System while other entities often join with the University System in the continuing education effort. Within the definition of education presented in Appendix Three, there are few educational programs outside of the University System.

The Agencies

The Department of Natural Resources and Conservation is currently participating in two educational efforts. The Conservation and Resource Division, in cooperation with the Riparian Association (a group based at the University of Montana School of Forestry), has an ongoing program in which public school teachers are taught the principals of water quality and sampling techniques. These teachers will then involve their students in a sampling program along the Clark Fork River and its tributaries and relate the results to non-point-source pollution.

Second, the Water Resources Division is currently participating in an educational program managed by the Water Center and co-funded by the U.S. Bureau of Reclamation. The objective of this program is to enhance natural resource education for public school students throughout the State by providing teacher-training workshops and course work materials.

Additionally, this program will provide educational experiences for water users and managers around the state in the areas of water law, water policy formation and in citizen participation in the water planning process.

The Water Quality Bureau participates with Montana State University in an annual school for Water and Waste water Operators and Managers. This program, and other workshops in which the WQB participates, provides Continuing Education Credits (CEC) that are required for the operators to maintain certification in their field.

The Department of Fish, Wildlife and Parks has recently begun a program called Project Wild Aquatic. The objective of this program is to provide public school educators with information and activity guides on Montana's aquatic resources and their management. The program is oriented toward fisheries and environmental issues. This is a national program that is being adapted to Montana's issues.

The University System

There are several academic programs within the university that include subject material relating to water. Examples include courses in chemistry, biology, microbiology, economics and geology that cover water-related topics. Other curriculums deal with water in a more comprehensive fashion. These curriculums and water specialty topics within them are described for each university unit as follows.

Montana College of Mineral Science and Technology.

HYDROLOGY: This subject area deals with the study of the occurrence and movement of water both below and above ground level. This course of study leads to both a B.S. and M.S. degree at Montana Tech.

ENVIRONMENTAL ENGINEERING: A large part of this curriculum deals with water quality management, water and waste water treatment and water quality modeling. A B.S. degree in Environmental Engineering is currently offered, and a M.S. degree was recently approved.

The University of Montana.

HYDROGEOLOGY: The study of the movement of water through geological formations and the chemical interactions that occur is called hydrogeology. These courses are offered in the Geology Department at both the undergraduate and graduate level. Degrees conferred are a B.S., M.S. and PhD in Geology.

ENVIRONMENTAL STUDIES. Environmental studies is an interdisciplinary masters degree program at the University of Montana. Students and faculty are drawn from several departments on campus and the course work has a heavy emphasis on aquatic ecology.

FOREST HYDROLOGY: This is a graduate program in the School of Forestry that relates hydrology and water quality to forestry practices and watershed management. Degrees offered are the M.S. and Ph.D. degrees in Forestry.

Montana State University.

CIVIL ENGINEERING: A part of this curriculum is devoted to water resources engineering, hydrology, hydraulics and environmental engineering. Degrees offered are a B.S., M.S. and Ph.D. in Civil Engineering.

EARTH SCIENCE: Geohydrology, the study of the interrelationships between ground and surface waters, and the physical earth and society, is an option offered in the Department of Earth Sciences. Degrees offered are the B.S., M.S. and Ph.D in Earth Sciences.

ENVIRONMENTAL ENGINEERING: The Environmental Engineering Degree at M.S.U. is a graduate degree within the Department of Civil Engineering. The program is oriented toward water quality control in natural and engineered systems, and toward the remediation of hazardous wastes in both ground and surface waters. The degrees offered are the M.S. in Environmental Engineering and the Ph.D. in Civil Engineering.

WATER RESOURCES ENGINEERING: Water Resources Engineering is a graduate option within the Department of Civil Engineering and includes courses in both surface and groundwater hydrology, water resources project planning and design, hydraulics, and economics. The degrees offered are the M.S. and Ph.D. in Civil Engineering.

Analysis

Although an abundance of water-related courses and programs exist within the university system, there is no curriculum in Water Resources. The closest program is the Water Resources Engineering program described above. However, this is a graduate engineering program and entry is restricted by a host of undergraduate math and engineering courses. An individual interested in a curriculum in Water Resources Management could find topic-related courses to take, but would not be able to get a degree that reflected the subject matter.

CONCLUSIONS AND RECOMMENDATIONS

After considering the current efforts described, the Policy Board is concerned with the lack of coordination and oversight of these activities. This concern relates primarily to two areas, cost effectiveness and credibility.

The cost effective concern is that, although millions of dollars are spent each year on research and related activities, there is no single entity with a mandate to provide comprehensive coordination, or even a collective record, of all of these activities. Furthermore, there is no oversight of all of these activities with respect to priorities. The Policy Board questions the overall effectiveness of such a fractionated approach.

The second concern is for the credibility of information generated under such a fractionated effort. As previously stated, good information is necessary to establish good policy and to write and defend good laws. In an era when policy and lawmakers must often defend their work in courts, the information on which their product is based must be of highest quality. It may be necessary to show that research activities were performed with the highest regards to objectivity and independence. The Policy Board feels that credibility could be enhanced significantly by the establishment and oversight of uniform protocol.

The Policy Board believes that these concerns can be addressed by a strong oversight and coordination effort using current resources, and without infringing upon existing institutional objectives. The Policy Board offers the following recommendations as a means of providing a coordinated and unified approach to water research and related activities which it feels will maximize the benefits from state expenditures.

OVERSIGHT AND COORDINATION

The Water Research Policy Board feels strongly that coordination and oversight must be accomplished by one entity in order to be effective. Because of the diverse nature of water research and related activities, a strong administrative structure will be required to bring them together into a cohesive, coordinated and cost effective unit. This administrative structure must include input from the organizations that are involved in the activities and from the water user community that the programs are intended to serve. The following elements are recommended:

1. A Water Research Oversight Council.
2. Advisory Committees that serve the Water Research Oversight Council in specific areas.
3. The Montana University System Water Resources Center.

The interrelationships of these entities are shown graphically on the following page. A detailed description of the elements of the administrative structure and their duties and responsibilities are given below.

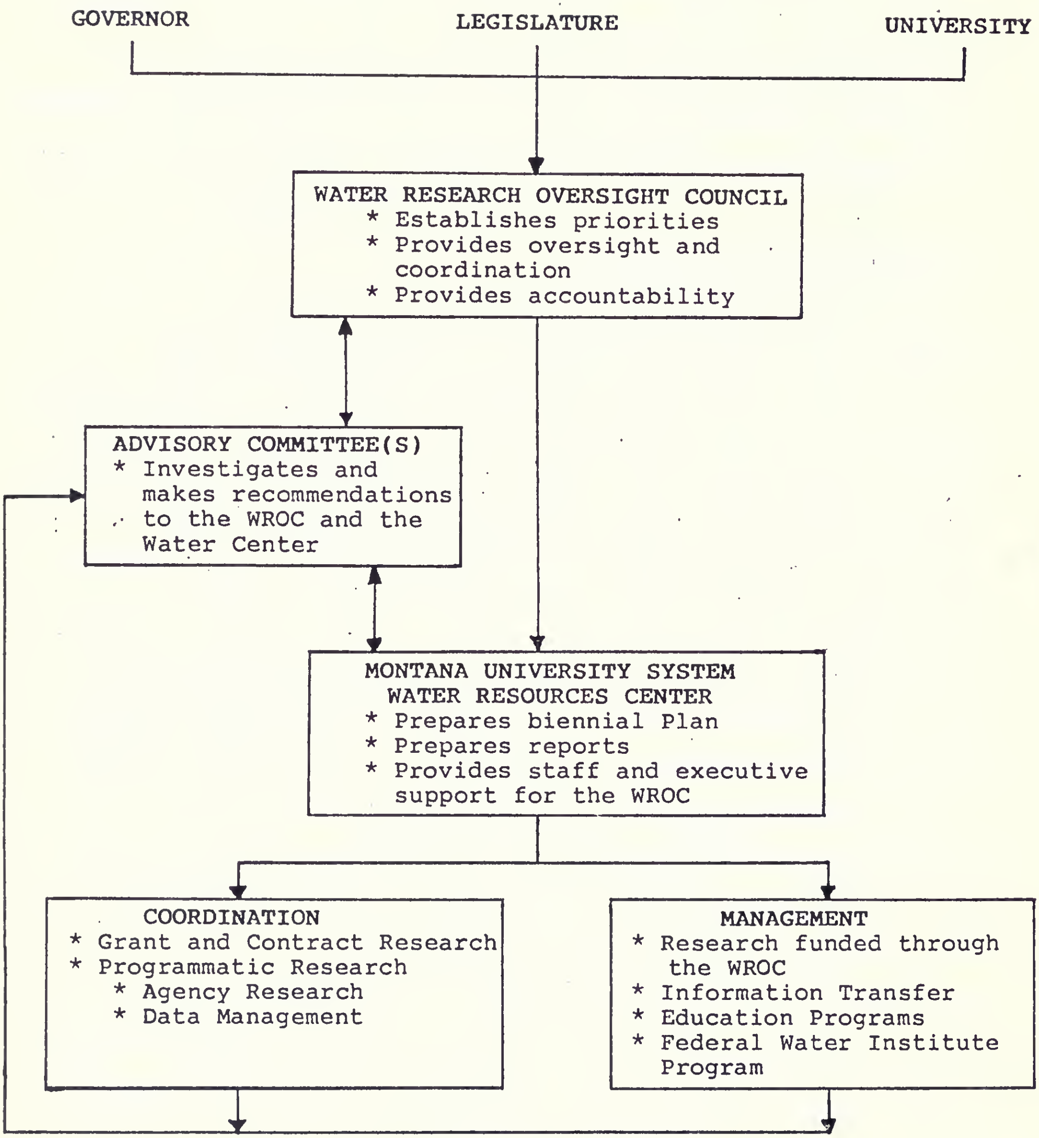

GOVERNOR
LEGISLATURE
UNIVERSITY
WATER RESEARCH OVERSIGHT COUNCIL
* Establishes priorities
* Provides oversight and coordination
* Provides accountability
ADVISORY COMMITTEE(S)
* Investigates and makes recommendations to the WROC and the Water Center
MONTANA UNIVERSITY SYSTEM WATER RESOURCES CENTER
* Prepares biennial Plan
* Prepares reports
* Provides staff and executive support for the WROC
COORDINATION
* Grant and Contract Research
* Programmatic Research
* Agency Research
* Data Management
MANAGEMENT
* Research funded through the WROC
* Information Transfer
* Education Programs
* Federal Water Institute Program

FIGURE 4. ADMINISTRATIVE STRUCTURE

Water Research Oversight Council

The current Interagency Water Research Policy Advisory Board offers a starting point for an oversight body, although the term "Advisory" should be dropped and the title should be changed to more adequately reflect its true mission. The suggested title is the Water Research Oversight Council (WROC).

Without infringing upon the statutory authority and responsibilities of the state agencies and the University System, the function of the WROC should be as follows:

1. to establish and oversee coordination of water research and related activities in the state;
2. to establish priorities for water research and related activities that are supported by funds appropriated by the state specifically for this purpose;
3. to provide management oversight and accountability for the expenditure of state funds appropriated specifically for water research and related activities.

To function as a policy making and oversight body, the WROC must be sanctioned by the executive and legislative branches of state government, and by the University System. Each of these entities should be represented on the Council. Appointments should be made by the Governor, the Legislature and the University System. Procedures for appointing members are recommended as follows:

* **Executive Branch:** The Governor should appoint three members to represent the Executive branch of state government. Appointments should be made from among directors of departments that have significant programs in water resources and/or from appropriate members of the Governor's staff.

* **Legislative Branch:** One member each should be appointed from the Water Policy Committee, The Environmental Quality Council, and the Long Range Planning Committee. The appointments should be made biannually by the Chair of each of these committees.

* **University System:** The University System members should be composed of the Vice Presidents for Research at Montana State University, the University of Montana, and Montana College of Mineral Science and Technology.

* **Private Sector:** Membership from the private sector should be appointed by the Governor. Each of the three members should be from different sectors of the water user/manager community with initial appointments of one, two and three years respectively. Subsequent appointments should be for three years in order to provide continuity.

Advisory Committee(s)

Because the membership of the WROC should be drawn from the policy making and administrative ranks, there will be a need for input of a technical nature that strikes a balance between the needs of the agencies, the water user community and university programs. Therefore one or more Advisory Committees should be appointed by the WROC to provide specific input on research, data management, information transfer and education. Advisory Committee(s) should be drawn from middle management levels of the agencies, from researchers in the University System, and from water users and managers in the private sector. The Committee(s) should meet at the call of the WROC, but at least on an annual basis, to prepare a list of needs for water research and related activities. These needs should be reported to the WROC for further consideration and for prioritization.

Staff

The WROC will need staff assistance to carry out its functions. The Montana University System Water Resources Center is a logical choice to serve this function because of the strong university involvement in all of the activities, and because of the Water Center's historical involvement in these areas. The Water Center would thus play a dual role. As staff for the WROC, it would serve as a coordinating entity between the state agencies and the university system in the areas of water research, data management, information transfer and education. As a university system entity, it would also manage the federal program under the Water Resources Research Act.

A detailed description of how this administrative structure would provide coordination and oversight of water research and related programs is given below.

RESEARCH

For coordination and oversight purposes, two separate categories of research must be considered. One category includes externally funded and programmatic research while the other category consists of state funded research, both of which were described in an earlier section of this report.

Externally Funded and Programmatic Research

As previously explained, efforts to reorient or control externally funded research and programmatic research would be counter-productive. There are, however, positive steps that should be taken to enhance the benefit of current water research efforts in the state, and to promote water research that would provide both direct and indirect benefits to Montana. A pro-active coordination effort and the integration of current research efforts by the WROC, appear to be the most effective means of addressing this problem.

Coordination. Even though little of the research funded through external grants may focus specifically on Montana water problems and issues, results of these projects may still be useful. Because circumstances and problems may be similar, the results of research are often transferrable. Therefore, the state may be able to benefit directly from research whose focus may have been generalized, or on a specific problem in another place. To maximize this benefit, it is necessary that researchers and water managers in Montana be aware of both recently completed research and of research in progress.

An Information Clearinghouse activity should be implemented to provide the following functions:

(1) Maintain a list of all current research projects in Montana that relate to water. This list should include a brief abstract of the project and means of contacting the researcher in charge.

2) Secure copies of final reports of all completed projects and catalogue these into a library accessible to all water interests in Montana.

3) Periodically publish abstracts of on-going and completed projects in a document that receives wide circulation within the water research, water manager, and water user communities.

The clearinghouse activity should incorporate information from all water research activities in the state, including the University System, the state agencies and the state grant programs.

Research Integration. A stronger link should exist between research in the University System, the state agencies and the state grant programs.

The state agencies often contract with faculty in the University System for research services. In most instances, this involves pass-through federal dollars. Consideration should be given to channeling all of the pass-through research dollars through the Water Resources Center. The Water Center would serve as the initial contact point for the agencies and could help the agencies select the best personnel for their projects. The Water Center could also track the research for the agencies and help insure that progress is maintained and that the flow of information and reports back to the agencies is timely. The Water Center could also serve in a quality assurance role by arranging peer review of project activity and reports.

State Funded Research

As previously noted, expenditures on water research and related activities from the three state grant programs have averaged about $1.6 million dollars per biennium for the last three bienniums. This portion of the three grant programs should be integrated with water research and related activities conducted in the university system and state agencies.

This integration should be accomplished by having water research proposals submitted in response to the priorities established by the WROC. The procedures by which this can be accomplished are presented in a later section of this report.

WATER DATA MANAGEMENT

Information management programs are essential to maximize the efforts of research, monitoring and other data gathering activities. Good information management programs can be highly cost effective in that they save vast amounts of time in searching for existing information. They help prevent costly duplication, and better management decisions result when good information is available to water professionals.

Because data management is an adjunct to research, it should be included in the coordination and oversight efforts previously described. The WROC should establish the relative importance of data management as compared to research and other related activities and direct available funds accordingly.

Effective coordination should be maintained to make sure that all data generated by research programs in the state be stored in an appropriate fashion. This data should be made available to the Water Information System and the Ground Water Information System, and should be disseminated through appropriate information transfer activities.

INFORMATION TRANSFER

In order to serve a useful purpose, the results of research and the availability of data must be made known to the practitioners in the field. Pro-active information transfer programs can accomplish this in several ways:

1. newsletters or other periodical publications,
2. announcements of the availability of research reports and other documents,
3. conferences, symposia and forums on timely topics.

As shown in a previous section, the water research community in Montana is active in information transfer. Most of the above activities are accomplished independently, or at best through an ad hoc arrangement for cooperation. The WROC should institute a comprehensive information transfer program that would coordinate existing activities and provide a comprehensive service to keep all of the water community in Montana informed of the services and events that are provided through the University System and the water agencies.

EDUCATION

As previously mentioned, there are two categories of water-related education. Formal course work is the responsibility of the University System units while several entities are involved in informal educational programs targeted to specific audiences.

The decision to implement a degree program in Water Resources must be made by the University System based on overall priorities and budget restrictions. However, the WROC should encourage the University System to put together a graduate program in water resources management using existing faculty and existing course work where possible. The possibility of an inter-campus program that would use the strengths available at the three campuses should be examined.

The Policy Board believes that citizen input to water policy development and to water management planning is critical to the success of those efforts. The Policy Board further believes that the quality of citizen input can be improved through education. Therefore, efforts to educate citizens on subjects relating to water use, conservation and management, and on water policy issues is an important activity and should be fostered and encouraged. However, the off-campus, non-degree education efforts should be coordinated to maximize the use of resources. These activities should be coordinated by the WROC with input from the Advisory Committee(s) and the Water Center.

RESOURCE REQUIREMENTS

The implementation of this program will require both financial and personal resources. Many of these resources are currently in place, but will require a reallocation and redirection. Other needs must be met with additional resources.

FINANCIAL RESOURCES

In addition to programmatic research funded in the state agencies and the University System, the state has spent an average of approximately $1.6 million dollars per biennium on water research and related activities from the three grant programs described earlier. It is recommended that this amount of funds be reallocated to the control of the Water Research Oversight Council. The remainder of these grant funds will continue to be administered in the present fashion, except that research and related activities will be excluded from those programs.

After input by the Advisory Committee(s), the WROC will decide how these funds should be allocated among the activities of research, data management, information transfer, education and administration.

Within the guidelines established by the WROC, and with input from the Advisory Committees, the Water Center will prepare a biennial plan for water research, data management, information transfer and citizen education projects that most effectively utilize the financial resources available. This plan must be reviewed and approved by the WROC and then submitted to the Long Range Planning Committee of the Legislature for its review and approval prior to funding.

PERSONAL RESOURCES

The current staff of the Water Center consists of the following:

Director - 0.4 FTE

Administrative Aide - 0.8 FTE

Associate Director (UM) - 0.1 FTE

Associate Director (TECH) - 0.1 FTE

Currently, a full-time Education Program Director and a half-time Education Specialist have been hired on a "soft money" basis through grants from the U.S. Bureau of Reclamation and the DNRC.

This allocation of administrative staff is barely sufficient to maintain the administrative functions of the current Center and will not be sufficient for the expanded role that has been recommended. Recommendations for staffing should ultimately come from the WROC, although suggestions and justification for an expanded staff have been the subject of discussions by the Policy Board and are presented below.

Director

The workload that will be required of the proposed program will necessitate a full-time Director. Travel requirements to Helena, to the other campuses and to other areas of the state to coordinate elements of the program preclude the regular teaching duties now performed by the current Director. The Director should spend approximately one-half of his/her time coordinating the overall program and the other half divided between managing the elements supported by the federal program and promoting research and education within the University System. This sharing of effort between the two functions should add flexibility to both elements of the program.

The Policy Board recommends that the University System consider funding the full-time Director's position from university funds.

Associate Directors

The role of the Associate Director's on the UM and Tech campuses should be expanded to assist in the promotion of water research and in coordinating an academic program. Because of the expanded effort, the time commitment of the Associate Directors should be increased to one-third FTE. Again, the Policy Board recommends that these positions be supported by university funds.

Program Managers

The expanded functions in information transfer and extension education will require some additional personnel. Currently, the Administrative Aide serves as editor of the newsletter and manages the reference service. Broadening the scope of the newsletter, coordination of conferences, and publication of reports, etc., will require additional effort. The current Administrative Aide position should be upgraded to that of

Information Transfer Program Manager on a full-time basis. A secretary will have to be hired to assume the secretarial duties currently handled by the Administrative Aide and the added duties imposed by the expanded program.

The Water Center recently began an extension education program to enhance water education in the public school system and to increase the level of awareness and understanding of water issues in the water user community across Montana. As noted earlier, a full-time Program Manager and a half-time Education Specialist have been hired on "soft money" to initiate this program. In order to provide continuity in the program, the Program Manager should be supported through the administrative structure of the Water Center. Thus, a full-time **Education Program Manager** should be added to the staff with all other education project staff continuing to be supported by external grant funds.

Research Staff

There is sufficient expertise within the university system to provide the research services necessary to meet the state needs. However, these researchers must be utilized more effectively to maximize the benefits from current state expenditures. This can be accomplished by matching the faculty expertise to the research needs.

Where existing research units are the logical entity to conduct specific research, for example the Biological Station (UM), the Bureau of Mines (MT. TECH) or the Reclamation Research Center (MSU), the appropriate amount of funds will be allocated to these organizations to do this work. Other research would be carried out by faculty members identified by their areas of expertise relative to the areas of research needed. Existing faculty within the university system will be used; no new hires will be necessary. Once a faculty member is identified and agrees to work on a project, arrangements will be made with his/her department to purchase an appropriate block of their time. The faculty member will then work part-time as a research faculty member associated with the Water Center for the duration of the project. Once the project has been completed, the faculty member's time will be released back to the department. It is anticipated that the faculty member would serve a minimum of one year and perhaps as much as two or three years as part of the Water Center staff.

In addition to faculty, graduate students would also work on research projects. These students will be assigned to research faculty to conduct work on specific projects and will be drawn from appropriate academic backgrounds.

For each project area approved by the Board, sufficient funds would be budgeted to pay the salaries of research faculty and graduate students, and for operating expenses associated with the project.

APPENDIX ONE

LIST OF PARTICIPANTS
RESEARCH/EDUCATION SYMPOSIUM
HELENA, MONTANA
JUNE 13, 1988

NAME	AGENCY	PHONE
1. Carrol Krause	Commissioner of Higher Educ.	444-6570
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4. Debra Schmidt	Environmental Quality Council	444-3742
5. Richard Phillips	Cooperative Extension Srv-MSU	994-6647
6. Nancy Mattina	UM Research Administration	243-6670
7. Larry Peterman	Fish, Wildlife & Parks	444-3183
8. Liter Spence	Fish, Wildlife & Parks	444-3888
9. Marvin R. Miller	MT Bureau of Mines & Geology	496-4155
10. Kip Gjerde	Bureau of Reclamation	657-6248
11. Bob Thompson	Environmental Quality Council	444-3742
12. Sen. Esther Bengtson	Water Policy Committee	373-5742
13. Joe A. Moreland	U.S. Geological Survey	449-5263
14. John Larson	MT Dept of Agriculture	444-2944
15. Bob Delk	BIA	657-6782
16. Wayne VanVoast	MT Bureau of Mines & Geology	657-2938
17. John Amend	Dept of Chemistry-MSU	994-5379
18. George Turman	NW Power Planning Council	444-3952
19. Richard Moy	DNRC	444-6633
20. John Wardell	EPA Montana Office	449-5432
21. John Thorson	Doney & Thorson	443-7018
22. Richard Juday	Dept of Chemistry-UM	243-2071
23. Arnold Silverman	Dept of Geology-UM	243-5151
24. Howard Peavy	Water Center-MSU	994-6690
25. Verne House	CES/Water Center-MSU	994-3511
26. Mary Byron	Water Center/CES-MSU	994-6690
27. Bert Kulecsa	U.S. Forest Service	
28. Gary Amestoy	Dept of State Lands	444-2074

APPENDIX TWO

WATER RESEARCH, INFORMATION AND EDUCATION PROGRAMS

A report to the Water Policy Committee
of the Montana Legislature

presented by

Dr. Carrol Krause
Commissioner of Higher Education

INTRODUCTION

At its meeting of February 26, 1988, the Water Policy Committee asked that my office facilitate an evaluation of existing procedures for conducting water research and related educational activities in Montana, and to make suggestions as to how these activities could be enhanced through better coordination. This evaluation has been completed with the help of many people in the University System, State and Federal Water Agencies, the legislature and the private sector. We are providing you with the following report of our efforts, what we found in the process, and what we are recommending as a means to enhance the water related research and education programs of the State of Montana.

FORMAL MEETINGS

Several formal meetings were held to discuss the subject. These included meeting with the Water Center director and associate directors, research administrators from the University of Montana, Montana College of Mineral Science and Technology and Montana State University, administrators of state and federal water agencies in Montana, and staff from the Water Policy Committee and the Environmental Quality Council. Ideas from these discussions formed the agenda for a meeting involving a large number of people from all sectors of the Montana water community. This day long meeting was held on June 13, 1988 at the Colonial Inn in Helena and examined the subject of research, education and information transfer activities relating to water in a most comprehensive manner. A list of the participants in this meeting is attached to this report. Many of the observations and recommendations in this report were drawn from this meeting.

These discussions identified current water research and educational efforts and examined ways of improving them. The following is a summary of what we believe to be the most salient points of these discussions.

NATURE OF CURRENT EFFORTS

Research can be broadly defined to include many activities. Basic research includes efforts to discover new facts and/or principles that may have universal application. Applied research seeks to identify those known facts and principles that might be useful in solving specific problems.

Investigations are narrowly focused efforts to obtain data needed to make management decisions, and may include obtaining new data or analyzing existing data files. All of these research types are used in the management of Montana's water resources, but receive different emphasis in the University System, the water agencies and other water use sectors.

University System

Water research in the University system consists of basic and applied research. Most of this effort is funded from outside sources through grants obtained by the individual researchers. The most successful researchers are those that have established a national or international reputation in a field of specialty that is of interest to one or more of the major funding agencies, such as NSF, EPA, etc. Because this research responds to priorities established by funding agencies outside of Montana, state guidance of these programs is impossible and any attempt to do so would, in fact, be counterproductive. These research projects are, however, very useful to the university community and to the state because they:

* motivate faculty to keep current in their field
* form a significant part of graduate program content
* help build and maintain laboratory space and equipment
* supplement university operating budgets

The latter is of particular significance during times of economic exigency such as we are currently experiencing. The overall externally funded research budget of the University System is approximately 12 million per year, with approximately 20% of this being water related research.

A smaller, but significant part of the university research effort is funded through state programs such as the Agricultural Experiment Station, the Forestry Station, the Bureau of Mines and other ongoing university programs, and through contracts with state agencies. This research is often of a more applied nature.

The state benefits indirectly from all research effort in the University System because it builds a body of knowledge and expertise relative to water, and because many of the students involved in the projects remain in Montana and become part of the water management community.

Water Agencies

Water agencies, both federal and state, also do, or contract for, water research. This research is primarily of the investigative nature with some applied research being done. Sampling and analysis for data to facilitate management decisions is the principal research activity. Applied research is often done in conjunction with researchers in the University System.

NEEDS AND DIRECTIONS OF FUTURE EFFORTS

The consensus of the participants in this evaluation process is that the current roles of the university system and water agencies are appropriate. There are, however, areas that would benefit from better coordination and greater financial support.

Research

The strong, externally funded research program of the University System should be maintained and expanded. The researchers must be free to follow lines of research within their expertise and in areas where funds are available. While relevant information from this research should be made available to the water community in Montana, we should not place restrictions on the researchers, nor should we impose an administrative burden on them by requiring additional reporting or paper work.

Good data is necessary to make good management decisions. The water agencies are in a better position to initiate and complete monitoring programs than is the University System. The agencies should continue in a lead role here, although closer interagency coordination might result in combined effort and some cost savings. The work of the Natural Resources Information System program in inventorying and indexing water data should prove very beneficial in the overall data needs area. This effort should be continued.

The principal weakness of the current system lies in the area of applied research that is directed toward Montana water problems and issues. The efforts of the water agencies and university researchers should be more closely coordinated with a greater level of communication relative to needs and efforts. A means should be established to identify critical issues and to prioritize research effort, using all available resources. Finally, current resources are not adequate to support the effort necessary to initiate and maintain a research program that meets the needs of the Montana water user/manager community.

Educational/Informational Services

In addition to research, information management programs are needed to insure that the results of completed and ongoing research are known and that duplication of this effort is avoided. There needs to be a clearing house for water related information that is accessible to all water interests in Montana. Not only should this clearing house catalogue and maintain information generated by researchers within the university units and water agencies in Montana, but it should actively seek out information published by others that is relevant to the use and management of water in Montana.

Good water management, particularly in the area of water policy, requires input from informed citizens. An educational program that brings water related information to the general public in a form that they can assimilate is therefore an important function of water management. This educational program should begin in the middle level grades of the public school system and continue through adult education programs. This program should be coordinated with the Office of Public Instruction. Use of existing resources, such as the water resources simulator developed by Dr. John Amend and others at Montana State, would be useful in this program.

Finally, the prospect of developing an interdisciplinary water resources degree program within units of the University System should be investigated.

RECOMMENDATIONS

Specific recommendations were made by the group that assembled on June 13, and by other groups and individuals that were consulted. These recommendations are as follows.

Unify state supported research efforts.

The research efforts of the state agencies and the university researchers should be unified as follows:

*Establish an Interagency Water Research Policy Advisory Board. This Board should be composed of heads of principal water agencies, top research administrators from the University System, representatives from appropriate legislative committees, and private sector representatives. This Policy Board would give overall direction to the research program and would:

1. set research goals
2. determine priorities for water research areas
3. identify appropriate research entities
4. identify available and potential funding sources
5. review research programs for consistency with established policy
6. submit a biennial research plan (the preparation of which is described below) through appropriate channels to the legislature for funding
7. serve as an advocate for the research program.

*Expand the scope of the current Water Center Advisory Committee. At the present, this committee only reviews proposals submitted to the Water Center from university researchers and makes recommendations for funding based on state research needs. This role should be expanded to:

1. identify research and informational needs of state water users and managers
2. review research programs of state agencies and the University System for consistency with the identified needs
3. prioritize research projects based on needs and consistency with policy set by Policy Advisory Board
4. identify areas where coordination of research programs would maximize benefits or conserve resources.

*Expand the role of the Montana University System Water Resources Center. In addition to its current role in administering the research program supported by the federal grant and matching funds, the Water Center should:

1. serve as the staff for the Policy Advisory Board and the Advisory Committee
2. prepare a biennial plan for research and coordination based on the policy of the Board and recommendations of the Committee (plan would be reviewed by the Policy Advisory Board and submitted by the Board through appropriate channels to the legislature)
3. Prepare a biennial report summarizing the results and application of the research program.

Establish an information clearing house.

The Water Center has maintained a modest effort toward this end for several years and this effort has recently been expanded. A news letter, a reference service, research updates and water issue forums are currently included in the Water Center program. Solicitation of materials relating to Montana water issues and summary reports on critical water issues should be added to this program. Maintaining up to date information on water research related activities of all water research and user/manager groups in Montana should be included in this clearing house function.

Establish an educational program.

Elements of the educational program were previously outlined and should be managed through the University System. These are:

1. Develop a training program for public school teachers to assist them in incorporating principles of water quality and quantity management in physical science and/or social science classes. This element would be coordinated with the Office of Public Instruction.
2. Develop an adult training program designed to increase awareness and understanding of water policy issues by water managers in state agencies, the legislature, the legal profession, and by water users and interested persons in the private sector. This program should be managed through the Cooperative Extension Service.
3. Review the potential for a graduate degree in Water Resources within the University System. The change over from the quarter to the semester system may present a unique opportunity to accomplish this as a coordinated program involving U. Of M., Tech. and M.S.U.

Establish a funding mechanism consistent with the requirements of the program.

The above recommendations cannot be carried out without some additional funding. Water Center funds, agency funds and special appropriations that are normally allocated for research can be used in an appropriate manner to finance those parts of the program that traditionally have been performed by these entities. A modification to the University System budget will be submitted by the University System and will propose a coordinated effort by several units of the university system and will, if funded, add some resources. Additional funding, as determined by the biennial plan prepared under the process suggested above, will be necessary to complete the unified package. Appropriate sources for these funds, such as the Water Development Fund, the RIT Fund, other designated accounts or the General Fund should be identified and allocated to complete the program.

CONCLUSIONS

This investigation has been a learning experience for all of those involved. The complexity of the water issues and the institutional arrangements for addressing these issues is astonishing if not astounding. The reason for the perplexity expressed by the Water Policy Committee and other legislative committees that must deal with the subject is readily understandable when one takes an in-depth look at the situation. The situation should be manageable, however, through a tightly organized, closely coordinated program such as the one outlined above.

If you concur with the proposed plan of action, we will proceed to invite membership appointment on the Interagency Water Research Policy Advisory Board consisting of the following:

Director of DNRC
Director of Dept. of Health
Director of Fish, Wildlife and Parks
Vice Presidents of Research at the University of Montana, Montana Tech and Montana State University
One member from the Water Policy Committee and one Member of the Long Range Planning Committee of the Legislature
Two representatives from the private sector

This board will convene and will review the elements of this proposal in detail and will make recommendations for its implementations. The efforts of the board will be reported back to you at your next meeting.

ADVISORY COMMITTEE - FY 1989
Montana University System
Water Resources Center

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APPENDIX THREE

DEFINITIONS

The following definitions have been used in establishing the boundaries of the efforts by the Board.

RESEARCH

In its broadest terms, research can be defined as the effort to discover new truths. These new "truths" may be in the form of basic principles by which processes occur, or by which natural or human-made systems work. Research of this nature is often called basic or theoretical research. On the other hand, research whose objective is to determine how the application of known scientific principles can be applied in a creative manner to existing problems is known as applied research. The term water research is reserved for projects whose principal focus is on the quantity, quality, use, distribution, conservation, allocation or economic benefits of water. Projects whose principal focus is on items or activities that only use water as a medium are not classified as water research projects. Such studies include projects on agriculture, fisheries, wildlife management, etc., where the principal focus in on the item or activity, not on the effects that water may have on this item or activity.

The collection of data that will be used only to establish current trends, document changes, or to buttress a management decision, is called monitoring and does not fall under the definitions of research cited above.

DATA MANAGEMENT

Data that is generated in the course of research and/or monitoring programs may serve a need beyond their original purpose. Generally, the initial phase of any research and/or management project includes a search for the results of other work in the same area. Where no formal procedure is available to assist in this effort, this search may be long and tedious and the person in need of the information may choose instead to obtain the needed data by initiating research or monitoring programs. Data management programs provide ready access to data and other useful information and can prevent the unnecessary duplication of research and monitoring programs.

There are several techniques for managing data and they vary depending on the purpose and resources available to the program. One approach is an indexing procedure in which the nature and location of the data is noted, but the data is not actually retrieved and stored on-site. Another approach is to pool data from all available sources into one file that is retrievable on demand. Some data management programs also provide statistical analysis of the data and/or help the user to interpret the information in light of his/her need.

INFORMATION TRANSFER

In order to serve a useful purpose, the results of research must be made known to the practitioners in the field. The production of a report on the results of a research effort is a necessary but insufficient form of information transfer. In a broader context, the goal of information transfer programs is to announce the completion of the project and the availability of the report to the community of professionals that are most likely to find the work useful.

EDUCATION

Education goes beyond the mere transfer of information. The goal of education is to enable a person to use information creatively in thought processes. In other words, to teach a person how to use information as opposed to just providing information (information transfer). Formal education programs in water-related areas are conducted in an academic setting and may constitute part of a degree program, or can be part of a continuing education program not leading to a degree. Informal education programs may consist of meetings and workshops where lectures and/or discussions meet the above criteria.

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